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An analysis of disaster prevention capability from a standpoint of social capital in Shinjuku-ku

By

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An analysis of disaster prevention capability from a standpoint of social capital in Shinjuku-ku

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This survey was targeted at local habitants of four areas (Yotsuya, Tansumachi, Enoki, Wakamatsu) in Shinjuku-ku, Tokyo. On August 31, 2010, the questionnaires were sent, requesting respondents to send a reply by September 28, to examine the correlation among local residents, communities and local administrations to cope with a natural disaster. Exploratory factor analyses to find a few latent background factors from many items obtained by the questionnaires to Shinjuku-ku residents were conducted. To predict the correlation of individual items and factors that existed behind them, Structural Equation Modeling (SEM) was used.

Introduction

To minimize the damage caused by a natural disaster, the cooperation among local residents, communities and local administrations is very important. Local capabilities of disaster prevention consist of (a) cognition for disaster prevention, (b) capability of community for disaster prevention, (c) reliability on public assistance.

According to precedence researches, problems were pointed out about voluntary organizations for disaster prevention, such as lack of applicable ideas and sufficient resources from local government¹. Moreover, aging society in Japan is stagnating disaster prevention activities. Under these circumstances, analyses of voluntary activities for disaster prevention, using the

concept of social capital, have begun in recent years.

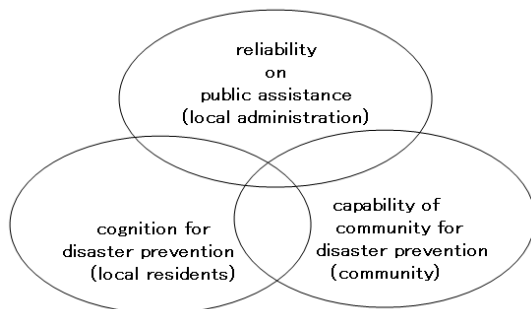
One of such studies concluded that factors which promote capabilities of community for disaster prevention are (a) existence of competent leaders, (b) existence of social capital in local community, (c) existence of institution to promote social capital². However, there are very few demonstrative researches to verify relations between social capital and capabilities of community for disaster prevention. Accumulation of data is expected. For that purpose, as a visiting researcher of Center for Social Capital Studies at Senshu University which has established a research project titled “Exploring Social Capital towards Sustainable Development in East Asia” funded by Ministry of Education, Culture, Sports, Science and Technology in 2009, I carried out the questionnaires in Shinjuku-ku, Tokyo in 2010.

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¹ Kuroda Yoji (1998) “The history and possibilities of voluntary disaster prevention organization in neighborhood,” *Journal of Japan Institute of Social Science*, vol.8, pp.255-257.

² Junko Suzuki (2005) “Roll of social capital in building up local capabilities for disaster prevention,” master’s thesis at Hosei Graduate School of Environmental Management in FY 2004.

Figure 1. Conceptual framework of disaster prevention capability



Objectives

Followings are the objectives for this study.

1. To examine correlation between local residents, community and local administration to cope with a natural disaster. That is to verify (a) cognition for disaster

prevention, (b) capability of community for disaster prevention, (c) reliability on public assistance.

2. To identify the main factors closely related to local capabilities for disaster prevention.
3. To find out the inter-relations among factors and rationalize their formation by model construction.

Methods

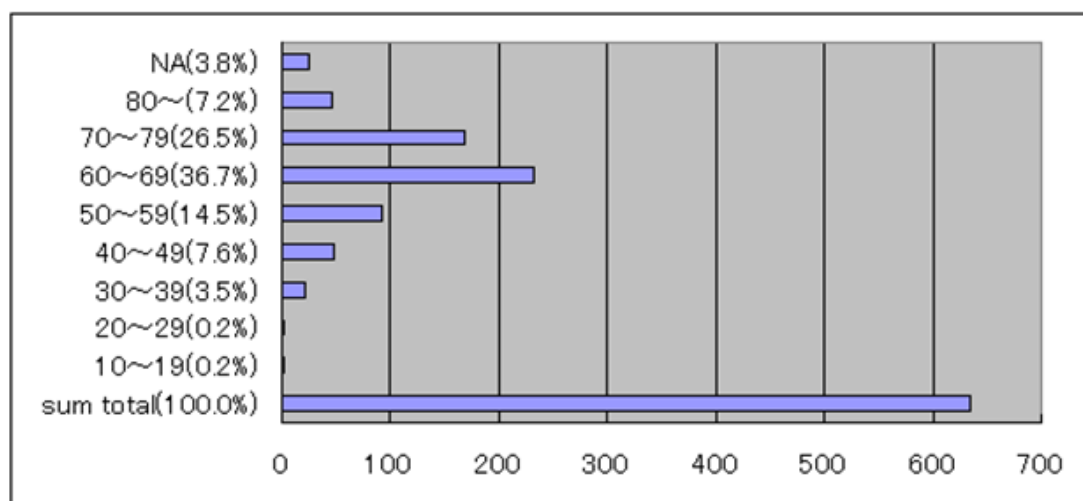
Conceptual framework of disaster prevention capability.

Figure 1 shows the conceptual framework of capability for disaster prevention. Exploratory factor analyses to find a few latent background factors from many items that were manifest factors obtained by the

Table 1. Recovery of questionnaires

area name	Yotsuya	Tansumachi	Enoki	Wakamatsu	total
number of dispatch	580	860	540	320	2,300
number of recovery	156	224	173	82	635
recovery rate	26.9%	26.0%	32.0%	25.6%	27.6%

Table 2. Age distribution of respondents



questionnaires to Shinjuku-ku residents were conducted. To predict the correlation of individual items and factors that exist behind them, Structural Equation Modeling (SEM) was used.

Data collection method. This survey was targeted at local habitants of four areas (Yotsuya, Tansumachi, Enoki, Wakamatsu) in Shinjuku-ku, Tokyo. Four areas are located in the eastern part of Shinjuku-ku³. As voluntary organizations for disaster prevention were established in almost all the small towns in Japan, the questionnaires were carried out through 115 neighborhood associations or residents' associations.

Survey period and sample characteristic.

On August 31, 2010, the questionnaires were sent from Center for Social Capital Studies at Senshu University, requesting a respondent to send a reply by September 28. The results of recovery of questionnaires are as in Table 1.

Organization of questionnaires. Items on the questionnaire sheet were prepared to match with framework of capability for disaster prevention shown at Figure 1. The questionnaires consisted of the following three categories. That is (a) the local activities for disaster prevention (Q1~Q14), (b) the cognition of society (Q15~Q20), (c) attribution of the respondent (F1~F10) .

³ Repeatedly, I explained the significance the questionnaires at Shinjuku Ward Office. As a result Joint Association of Shinjuku Neighborhood Associations and Residents' Associations kindly decided to cooperate with this survey formally.

Table 3. Question items about local activities for disaster prevention

Q1 existence of experience of natural disasters
Q2 traditional successions of disaster experiences
Q3 cognition for origins of voluntary organization by residents
Q4 reliability on a certain person or organization as shown below in the event of a natural disaster
(a) family
(b) neighbors
(c) relatives
(d) acquaintances or friends
(e) colleagues or coworkers
(f) voluntary organizations for disaster prevention
(g) self-fire brigade
(h) other volunteer organizations or NPO
(i) police or fire-authorities
(j) hospitals
(k) Shinjuku Ward Office
(l) Tokyo Metropolitan Government
(m) Self-Defense Forces
Q5 frequency of participation in voluntary activities for disaster prevention
Q6 how in charge of voluntary organization for disaster prevention
Q7 frequency of voluntary activities for disaster prevention
Q8 practice of prevention measures for disasters by residents
Q9 self-assessment on organizational capability of voluntary organization for disaster prevention
Q10 expectation toward Shinjuku Ward Office about disaster prevention measures
Q11 expectation toward Tokyo Metropolitan

Government about catastrophic disaster
Q12 existence of units of the Self-Defense Forces in nearby area
Q13 visit experience of the unit of the Self-Defense Forces
Q14 expectation toward the Self-Defense Forces about catastrophic disaster

Table 4. Question items about the cognition of society

Q15 reliability on society in general
Q16 reliability on people while traveling
Q17 association with relatives
Q18 association with friends or acquaintances outside workplace
Q19A frequency of association with neighbors
Q19B ratio of neighbors in association
Q20 reliability on a certain person or organization as shown below in worries and troubles
(a) family
(b) neighbors
(c) relatives
(d) acquaintances or friends
(e) colleagues or coworkers
(f) neighborhood associations or residents' associations
(g) volunteer organizations or NPO
(h) religious groups
(i) police or fire-authorities
(j) schools or hospitals
(k) political party or politician
(l) Shinjuku Ward Office
(m) Tokyo Metropolitan Government
(n) central government

Table 5. Question items about attribution of the respondent

F1 sex
F2 age
F3 occupation
F4 type of dwelling
F5 number of people living-together
F6 habitation years in Shinjuku-ku
F7 hope of continuous habitation in Shinjuku-ku
F8 degree of satisfaction of living in Shinjuku-ku
F9 prediction of living standard in 5 years
F10 living standard compared with 5 years before

In many question items like Q4 or Q20, respondents were requested to choose one opinion by its number from among the five Likert scale options from “greatly reliable” through “not reliable at all”. The number chosen was rated respectively as positive 5 to negative 1 in the process of statistical transaction.

Results

Factor analysis about the conceptual framework of disaster prevention capability.

We can find out a few latent background factors from a large number of manifest factors. First we conduct exploratory factor analysis about the framework of capability for disaster prevention shown in Figure 1. This framework is supposed to be made up of three elements, (a) cognition for disaster prevention, (b) capability of community for disaster prevention, (c) reliability on public assistance. Judging from correlation matrix, we picked up 9 items from these questionnaires.

Table 6. Factor analysis about the conceptual framework of disaster prevention capability

maximum likelihood method, varimax rotation				
naming	items	factor1	factor2	factor3
reliability on public assistance	(a) reliability on hospitals	0.836	-0.036	0.127
	(b) reliability on police or fire-authorities	0.809	-0.087	0.085
	(c) reliability on Shinjuku Ward Office	0.773	0.089	0.138
cognition for disaster prevention	(d) cognition for origin of voluntary organization by residents	0.017	0.480	0.184
	(e) frequency of participation in voluntary activities for disaster prevention	-0.023	0.843	0.168
	(f) how in charge of voluntary organization for disaster prevention	-0.011	0.512	0.143
capability of community for disaster prevention	(g) frequency of voluntary activities for disaster prevention	0.109	0.377	0.652
	(h) self-assessment on organizational capability for disaster prevention	0.118	0.182	0.761
	(i) reliability on voluntary organization by residents	0.352	0.231	0.448
eigenvalue		2.101	1.449	1.331
proportion(%)		23.35	16.10	14.78
cumulative proportion(%)		23.35	39.45	54.23
correlation			-0.008	0.346
				0.607

9 items are (a) reliability on hospitals, (b) reliability on police or fire-authorities, (c) reliability on Shinjuku Ward Office, (d) cognition for origins of voluntary organization by residents, (e) frequency of participation in voluntary activities for disaster prevention, (f) how in

Table 7. Correlation matrix of factor analysis

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
(a)	1.000	0.689	0.667	-0.016	-0.028	0.000	0.191	0.176	0.320
(b)	0.689	1.000	0.624	0.033	-0.085	-0.041	0.092	0.145	0.336
(c)	0.667	0.624	1.000	0.078	0.088	0.039	0.189	0.229	0.348
(d)	-0.016	0.033	0.078	1.000	0.428	0.268	0.363	0.190	0.197
(e)	-0.028	-0.085	0.088	0.428	1.000	0.461	0.420	0.282	0.264
(f)	0.000	-0.041	0.039	0.268	0.461	1.000	0.266	0.211	0.191
(g)	0.191	0.092	0.189	0.363	0.420	0.266	1.000	0.577	0.407
(h)	0.176	0.145	0.229	0.190	0.282	0.211	0.577	1.000	0.434
(i)	0.320	0.336	0.348	0.197	0.264	0.191	0.407	0.434	1.000

charge of voluntary organization for disaster prevention, (g) frequency of voluntary activities for disaster prevention, (h) self-assessment on organizational capability for disaster prevention, (i) reliability on voluntary organization by residents. Respondents were requested to choose one opinion by its number from among the five Likert scale options, however from among the six Likert scale options on item (f).

The result of exploratory factor analysis (maximum likelihood method, varimax rotation) is shown above⁴.

Concluding from eigenvalue and correlation matrix after varimax rotation, this model was suitable for 3-factor structure. We can name factor 1 as “reliability on public assistance”, factor 2 as “cognition for disaster prevention”, factor 3 as “capability of community for disaster prevention”.

SEM with three latent factors. Structural Equation Modeling (SEM) was applied to predict the correlation of manifest factors or latent factors that might existed behind the framework of disaster prevention. The result of SEM with three

latent factors is as follows⁵. Sample size is 502. P values of all paths in this figure are below 0.01 ($p < 0.01$).

To describe the subordinate items of each factor, first latent factor “capability of community for disaster prevention” included “frequency of voluntary activities (0.778)”, “self-assessment on organizational capability (0.708)” and “reliability on voluntary organization by residents (0.590)”. Second latent factor “cognition for disaster prevention” included “frequency of participation in voluntary activities (0.809)”, “how in charge of voluntary organization for disaster prevention (0.554)” and “origin of voluntary organization by residents (0.534)”. Third latent factor “reliability on public assistance” was broken down into “hospital (0.862)”, “police or fire-authorities (0.799)” and “Shijuku Ward Office (0.777)”.

The model showed a cause-and-effect relation of “capability of community for disaster prevention” with “cognition for disaster prevention (0.607)” and “reliability on public assistance (0.556)”. In this model, “capability of community for disaster prevention” became an

⁴ Through this analysis, statistics software named Excel Statistics 2010 was used which was produced by Social Survey Research Information Co. Ltd, Tokyo, Japan.

⁵ Takaya Kojima wrote a book “Covariance Structure Analysis and Graphical Modeling by Excel” in 2003 published by Ohm Inc. Tokyo Japan. I made use of attached soft ware of this book to analyze SEM.

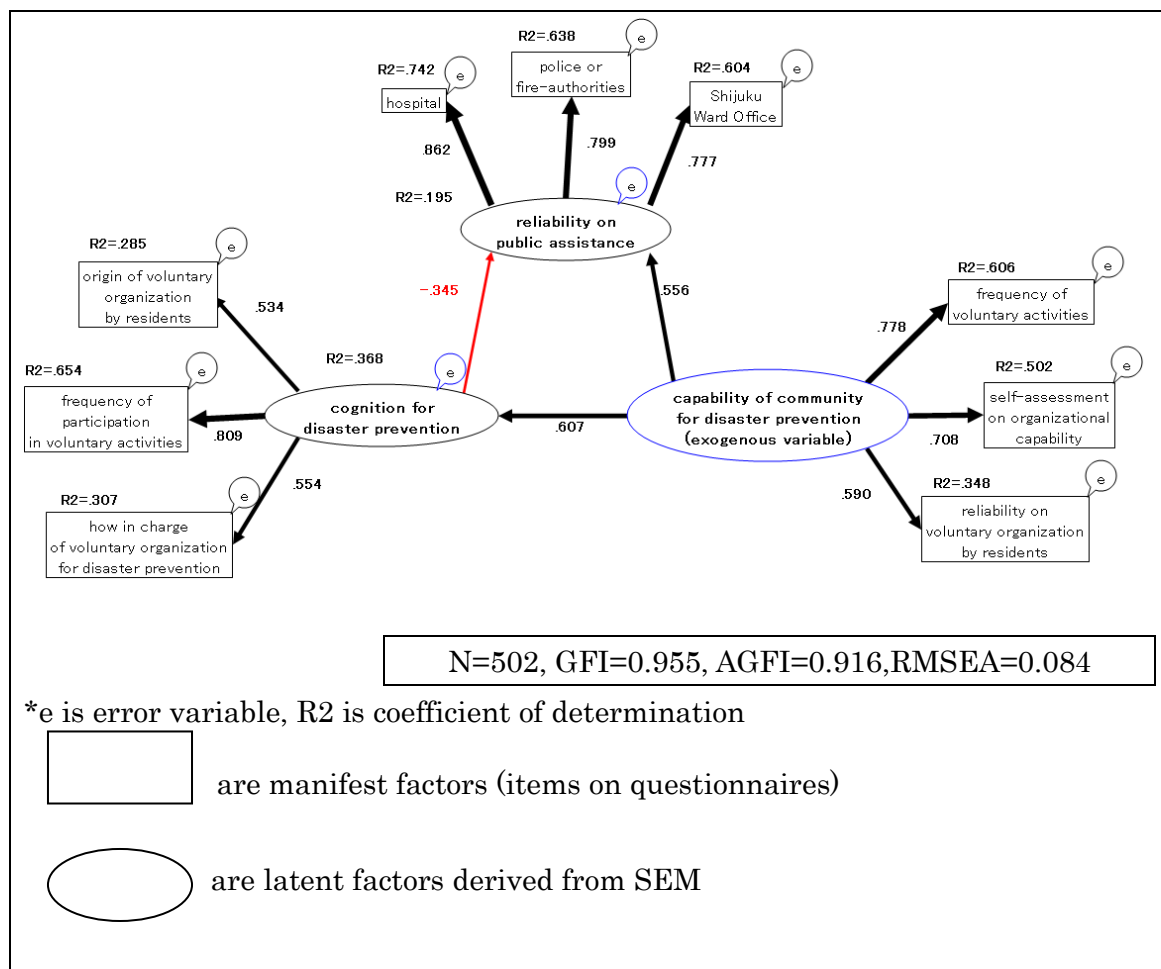


Figure 2. Pass diagram with three latent factors

exogenous variable. On the other hand, “cognition for disaster prevention” had a negative correlation with “reliability on public assistance (-0.345)”. In sum, the higher cognition for disaster prevention by residents, the lower needs of public assistance. By this SEM analysis, validity of conceptual framework of capability for disaster prevention shown at Figure 1 was mostly proved.

SEM with four latent factors. In a SEM model with three latent factors, a latent factor of “capability of community for disaster prevention” became an exogenous factor. In this context, “capability of community for disaster prevention” is

higher than “cognition for disaster prevention” or “reliability on public assistance”. If we add another latent factor to this SEM model, there would be a possibility that “capability of community for disaster prevention” may not become an exogenous factor. To make a SEM model with four latent factors, we added some items on Q20 as of social capital. As for Q20, respondents were requested to choose one opinion by its number from among the five Likert scale options about reliability on a certain person or organization as shown in worries and troubles.

In this model with four latent factors, “social capital of neighborhood” became an exogenous

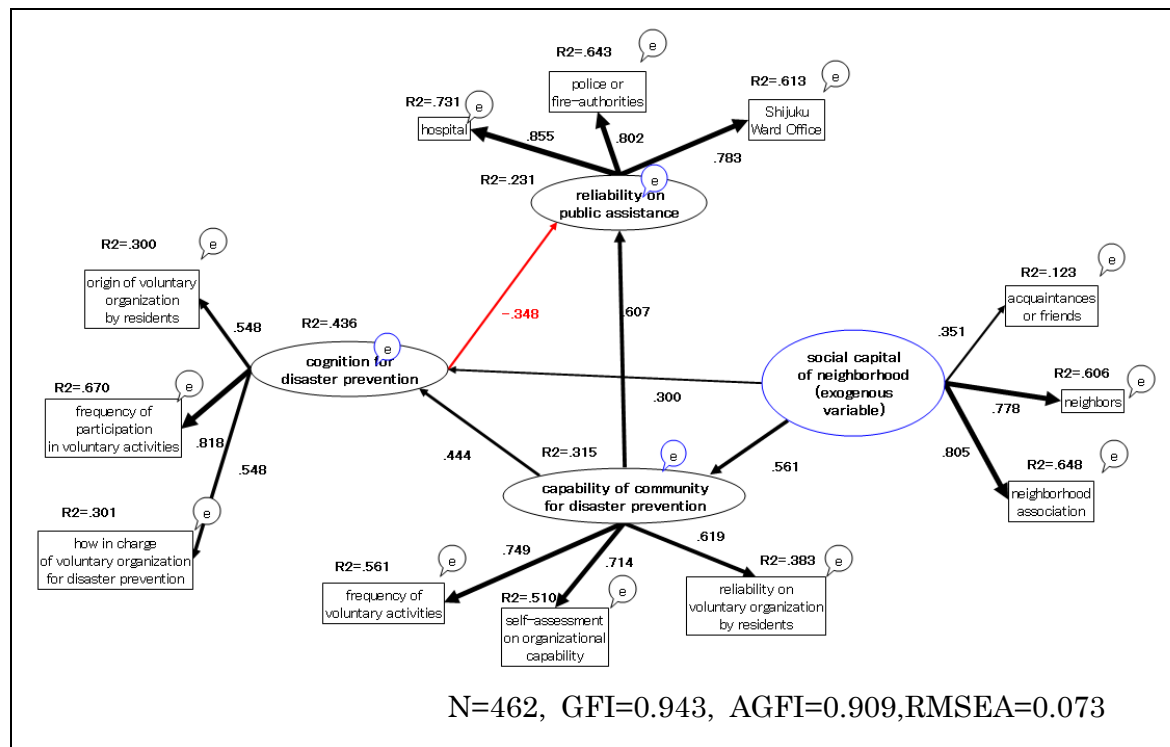


Figure 3. Pass diagram with social capital factors

factor. This exogenous factor included “neighborhood association (0.805)”, “neighbors (0.778)” and “acquaintances or friends (0.351)”. Sample size is 462. P values of all paths in this figure are below 0.01 ($p < 0.01$).

The model shows a cause-and-effect relation of an exogenous factor of “social capital of neighborhood” with “capability of community for disaster prevention (0.561)” and “cognition for disaster prevention (0.300)”. Furthermore, “capability of community for disaster prevention” had a cause-and-effect relation with “reliability on public assistance (0.607)” and “cognition for disaster prevention (0.444)”. An exogenous factor of “social capital of neighborhood” did not have a direct relation with “reliability on public assistance”. Also in this model, “cognition for disaster prevention” had a negative correlation with “reliability on public assistance (-0.348)”.

Differences by age. By making cross tables from various items in questionnaires, we can find some differences by age of respondents. The Chi-square test showed significant differences between those of less than 60 years and those of 60 years or more. Followings are analysis by SEM model with social capital factors.

Figure 4 shows pass diagram with social capital factors (30’s-50’s). Sample size is 145. P values of all paths in this figure are below 0.01 ($p < 0.01$). This model showed a cause-and-effect relation of an exogenous factor of “social capital of neighborhood” with “cognition for disaster prevention (0.702)” and “capability of community for disaster prevention (0.594)”. “Capability of community for disaster prevention” had a cause-and-effect relation with “reliability on public assistance (0.544)”, however, it did not have a cause-and-effect relation with “cognition for

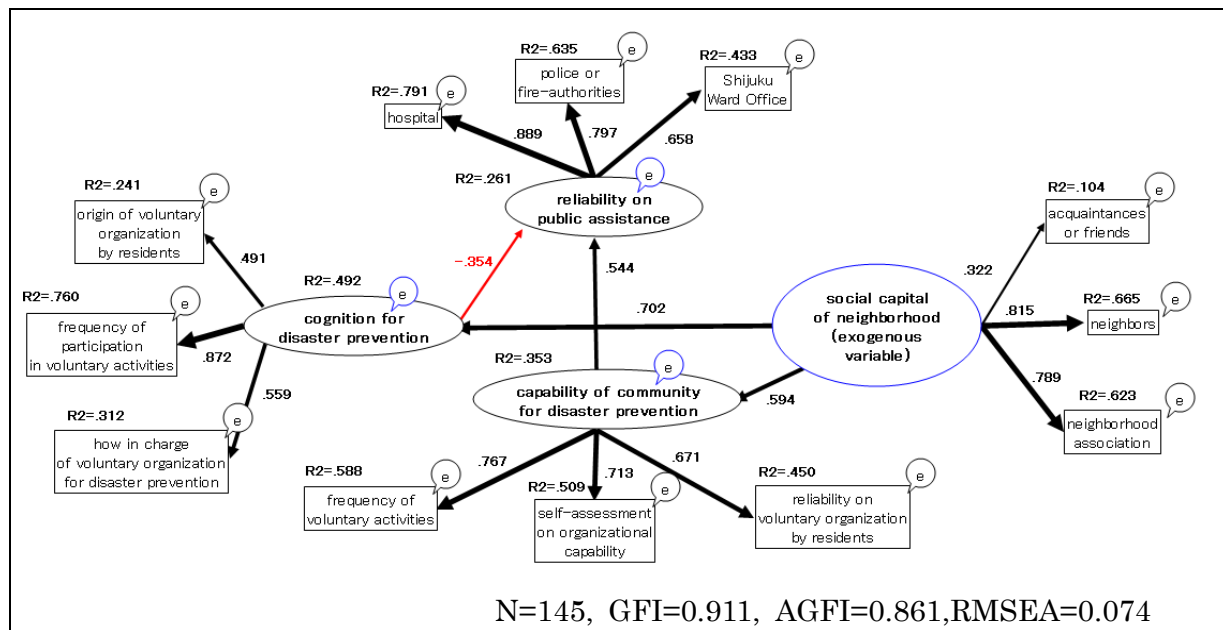


Figure 4. Pass diagram with social capital factors (30's-50's)

disaster prevention". An exogenous factor of "social capital of neighborhood" did not have a direct relation with "reliability on public assistance".

Also in this model, "cognition for disaster prevention" had a negative correlation with "reliability on public assistance" (-0.354)".

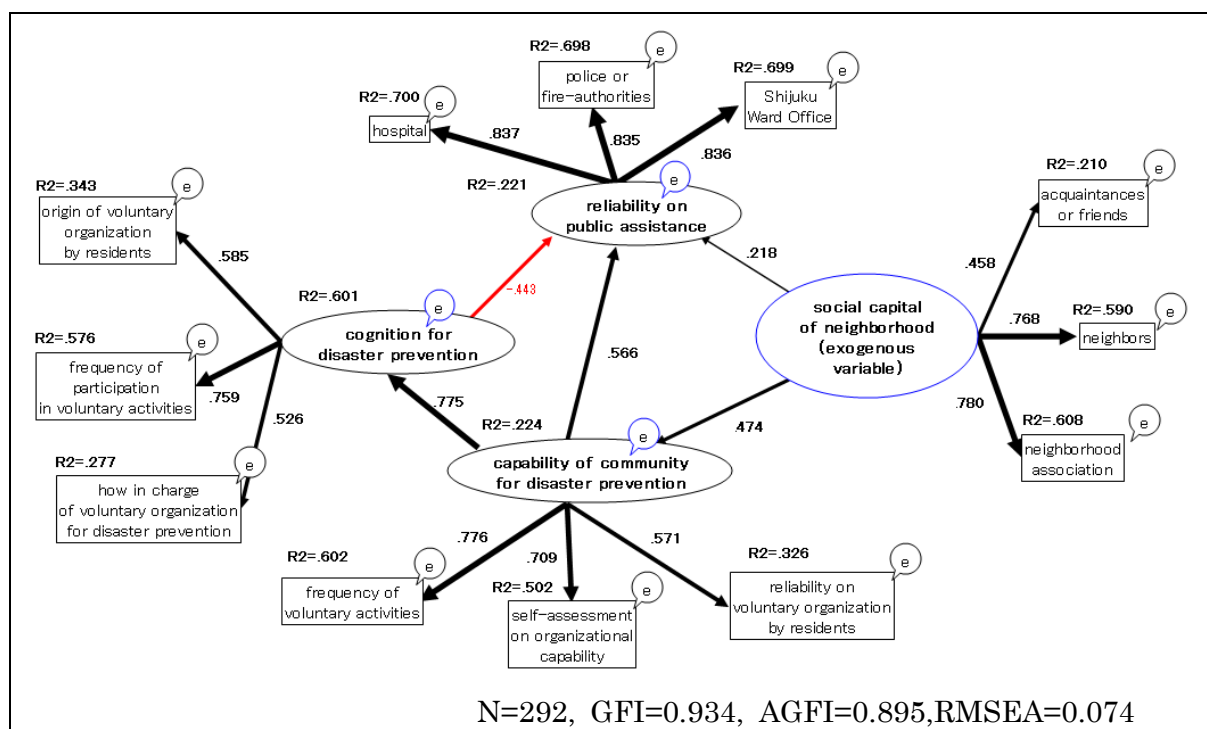


Figure 5. Pass diagram with social capital factors (60's-70's)

Figure 5 shows path diagram with social capital factors (60's-70's). Sample size is 292. P values of all paths in this figure are 0.01 or less ($p \leq 0.01$). This model had a considerably different shape compared with Figure 4. Thus an exogenous factor of "social capital of neighborhood" had a cause-and-effect relation of with "capability of community for disaster prevention (0.474)" and "reliability on public assistance (0.218)". "Capability of community for disaster prevention" had a cause-and-effect relation with "cognition for disaster prevention (0.775)" and "reliability on public assistance (0.566)". Also in this model, "cognition for disaster prevention" had a negative correlation with "reliability on public assistance (-0.443).

Compared with Figure 4 and Figure 5, we can find out the following differences. First "cognition for disaster prevention" of respondents aged from 30's to 50's was directly derived from their "social capital of neighborhood". And this relation is very strong (0.702). On the other hand, "cognition for disaster prevention" of respondents aged from 60's to 70's was not directly derived from their "social capital of neighborhood". Their "social capital of neighborhood" had a mere indirect relation with "cognition for disaster prevention" via "capability of community for disaster prevention". This indirect relation was estimated to be 0.367 (0.474×0.775).

Second "social capital of neighborhood" of respondents aged from 60's to 70's had a direct relation with "reliability on public assistance (0.218)". On the other hand, "social capital of neighborhood" of respondents aged from 30's to 50's did not have a direct relation with "reliability on public assistance". Furthermore, an indirect

relation with "reliability on public assistance" via "cognition for disaster prevention" and "capability of community for disaster prevention" would be almost neutral because of offset between a positive relation via "capability of community for disaster prevention" and a negative relation via "cognition for disaster prevention".

Third, "capability of community for disaster prevention" of respondents aged from 60's to 70's had a strong cause-and-effect relation with "cognition for disaster prevention (0.775)", while "cognition for disaster prevention" of respondents aged from 30's to 50's was directly derived from their "social capital of neighborhood (0.702)".

Conclusion

Validity of conceptual framework of capability for disaster prevention was mostly to be proved by SEM analysis with three factors of "capability of community for disaster prevention," "cognition for disaster prevention," and "reliability on public assistance".

Through SEM analysis with "capability of community for disaster prevention," "cognition for disaster prevention," "reliability on public assistance" and "social capital of neighborhood," "social capital of neighborhood" was an exogenous factor.

This model showed a cause-and-effect relation of "social capital of neighborhood" with "capability of community for disaster prevention" and "cognition for disaster prevention". In Shinjuku-ku, "social capital of neighborhood" did not have a direct relation with "reliability on public assistance". And "cognition for disaster prevention" had a negative correlation with "reliability on public assistance".

The Chi-square test showed significant differences between those of less than 60 years and those of 60 years or more.

By pass diagram with social capital factors,

- (1) "cognition for disaster prevention" of respondents aged from 30's to 50's was directly derived from their "social capital of neighborhood".
- (2) "cognition for disaster prevention" of respondents aged from 60's to 70's was not directly derived from their "social capital of neighborhood".
- (3) "social capital of neighborhood" of respondents aged from 60's to 70's had a direct relation with "reliability on public assistance"
- (4) "capability of community for disaster prevention" of respondents aged from 60's to 70's had a strong cause-and-effect relation with "cognition for disaster prevention".
- (5) "cognition for disaster prevention" of respondents aged from 30's to 50's was directly derived from their "social capital of neighborhood".

Limitation of the study

As I could not use the official statistics regarding Shinjuku residents personal information for the throughout distribution, the majority of respondents of questionnaires in this survey was sixties and seventies. This bias might be related to aging of activities of neighborhood associations or residents' associations.

Objectivity of the assessment is not necessarily ensured, as assessment was subjectively evaluated by residents in Shinjuku-ku regarding

organizational capability of voluntary organization for disaster prevention.

There is some room for an improvement of questionnaires and SEM models from point of indices as a measure of suitability such as GFI, AGFI, and RMSEA.

Acknowledgments

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